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# NUTRITION PROGRAM NEWS

U. S. DEPARTMENT OF AGRICULTURE, WASHINGTON, D. C.

MARCH-APRIL 1971

## Nutrition and Learning—Implications for Schools

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For many years, nutritionists have sought to establish the relationship of nutrition to learning.

In 1948, H. C. Sherman, long interested in the nutritional improvement of life, made the following observation (1):<sup>1</sup>

"The same material conditions which make the brain relatively well protected tissue make it less easy to demonstrate the effect of diet upon mental than upon physical work. But we have seen examples in which a more scientific guidance of nutrition resulted in higher mental as well as physical efficiency, even in people who were already healthy and efficient; and the present day science of nutrition shows that this is logically to be expected.

"Our bodies have wonderful, self-regulating 'mechanisms,' yet our food does influence our bodily internal environment. Here the blood is the great mediator and the same blood circulates through every part of the body, carrying the influence of the food (whether for better or worse) to muscle and brain alike."

Since 1948, many researchers have worked in this area and have established facts to show the effect of nutrition on the central nervous system.

Reports of findings in developing countries where there is a high incidence of protein-calorie malnutrition, have increased the interest in and concern for the nutritional health of U.S. school children. In this issue of Nutrition Program News, we present a thumbnail sketch of the effects that nutrition can have on the learning ability of children and the role that the schools can play in influencing the nutrition of U.S. school children (2).

### INFLUENCE OF MALNUTRITION ON THE CENTRAL NERVOUS SYSTEM

Research findings of the last ten years strongly suggest that nutrition can influence intellectual performance and

learning. Nutrition can influence the structure and the function of the brain and the rest of the central nervous system. The effect that protein-calorie malnutrition has on the brain structure or function varies with the age at which malnutrition occurs, how severe it is, and how long it lasts.

In this paper, malnutrition or undernutrition is defined as a state in which an individual lacks one or more essential nutrients to the extent that specific symptoms or conditions of impaired health (including retardation in physical development) appear.

### Pattern of growth

Normal growth of the body and of individual organs begins with cell division. Later, growth is made by increases in both the number and size of cells. Finally, cell division ceases and growth continues only through increases in cell size.

### Introducing — Mrs. Margaret Stewart, M.S., Home Economist

Nutrition Program News has a new pilot at the helm. Mrs. Margaret Stewart has assumed responsibility for planning and preparing the issues.

Mrs. Stewart earned her M.S. degree in Food Science and Nutrition at Florida State University. Her experience is varied including both teaching and research. If you have suggestions for topics to be covered or descriptions of successful activities in school or community nutrition programs that you are willing to share with our readers, please send them to Mrs. Stewart and she will give them careful consideration.

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<sup>1</sup> Italic numbers in parentheses refer to References, p. 4.

## **Malnutrition and brain growth**

During times of malnutrition, the organs that are growing are more susceptible to damage than those that are stable in size. Also, organs that are undergoing cell division are more susceptible to damage than those in which cell size alone is increasing. The faster the growth rate, the more vulnerable the organism.

The brain grows most rapidly from 3 months before to 6 months after birth. It is dependent on a supply of energy and nutrients for normal growth. Any prolonged and severe interruption or deficiency in nutrients or calories may result in retarded physical and behavioral development.

## **Severe malnutrition and brain development**

In experimental animals, severe malnutrition that occurs during the time of brain cell division results in fewer cells (3). Such retardation of growth is not reversible unless malnutrition is corrected before brain cell division ceases. Severe malnutrition at this stage of life can be accompanied by long-lasting behavioral changes and reduced capacity to learn.

The same pattern appears to exist in humans. Studies of the brains of young children who died of malnutrition, compared with those who died from accidents, showed malnourished youngsters had as little as 40 percent of the expected number of brain cells. Infants and children who are chronically underfed and malnourished have a smaller head circumference, smaller brain mass, and retarded growth (4). Permanent effects on behavior and brain development of humans are possible if severe protein-calorie malnutrition occurs prior to 6 months of age.

## **Malnutrition, environment, and heredity**

Rarely is a child afflicted only with malnutrition (5). Poverty and disease usually accompany, even cause it. Other factors can also influence a child's behavior and his capacity to learn. These include genetic disadvantages, lack of stimulation, lack of affection, and low IQ and/or education of the mother.

It would be advantageous to know the effect of malnutrition alone on capacity to learn. However, it is difficult to design a human study which eliminates all factors except nutrition.

## **RESEARCH ON EFFECT OF MALNUTRITION ON MENTAL DEVELOPMENT**

A number of researchers have studied malnourished children in order to determine the effect of malnutrition on mental development and behavior as opposed to the effect of other physical conditions or social and cultural influences on mental development and behavior. Some of

these studies have been done on a population with a known history of malnutrition. A portion of this population was fed a nutritional supplement, and the resultant differences were noted.

## **Studies in Guatemala**

The Institute of Nutrition of Central America and Panama is working in Guatemalan villages in a study of this nature (6). Six villages of matched economic, social, medical, and nutritional status have been selected for participation in the research program. Only pregnant mothers and their newborn children in these villages are studied. Experimental groups are given nutritionally adequate food supplements; control groups are not given the nutritionally adequate supplements. This research is designed to establish what relationship exists between food supplementation and intellectual growth.

## **Studies in Mexico**

In Mexico, Dr. J. Cavioto is currently studying a large sample of children to determine the effects of nutrition on physical and mental development (7). All children born in a 1-year period in a selected village became part of the sample group. The children are given frequent physical examinations and tests to determine their intelligence and muscular and language development. The children's diets for 3 days each month are recorded, and mothers' attitudes are noted. Thus, each child's physical and mental development is determined, his diet pattern is recorded, and his home situation studied.

Physical and mental attainment of each child at age seven will be noted in terms of nutritional status and other aspects of his life.

## **DELAYED, MODERATE MALNUTRITION AND BRAIN GROWTH**

We have primarily been discussing early severe malnutrition—malnutrition which tends to cause irreversible retardation in intellectual ability. This severe malnutrition is rare in the United States.

However, malnutrition can and does often occur later in a child's life. Malnutrition after the period of rapid brain growth also has an effect on brain cells. This effect is not a reduction in the number of brain cells, as with early severe malnutrition, because the cells have already been formed. Rather, the effect is to keep the size of the cells small.

When malnutrition is overcome, cells reach their expected size. Intellectual and behavioral retardation from this type of malnutrition may not be long-lasting, and improvement may parallel improvement in health.



## COMMON NUTRITIONAL PROBLEMS IN THE UNITED STATES

Preliminary findings of the National Nutrition Survey, initiated in 1968, indicate that some extreme cases of malnutrition do exist under conditions of severe poverty in this country (8). A few cases of kwashiorkor and marasmus were found. Severe nutrition problems in poverty groups seem similar to, but less frequent than, those encountered in developing countries.

The National Nutrition Survey studied primarily low-income families. The average family income was less than \$3,000 per year. High incidences of undernutrition were found. One-third of the children under six had blood hemoglobin levels in an unacceptable range. One-third of the children under six had serum vitamin A levels that were unacceptable (8).

However, the much more common nutritional problems in this country are less severe. Mildly inadequate or borderline intake of specific nutrients occurs frequently among the poor. This can affect the functioning of the central nervous system and, therefore, the learning ability and behavior of a child. Prolonged inadequate calorie or nutrient intake results in weakness, fatigue, and depression of motor activities.

School authorities are concerned with the nutritional status of children. They need to identify those situations which they can improve, and they need to determine how best to help each child proceed toward his potential.

### MALNUTRITION IN SCHOOL-AGE CHILDREN

The functioning of the central nervous system is a vital factor in the learning process. Long before school age, the structure of the nervous system has been established. Even with adequate nutrition, it is too late to do certain things for a child who was severely malnourished in the first few months of his life. Brain defects cannot be corrected. Brain growth cannot be rekindled. The limitations imposed upon the brain and central nervous system are largely permanent. But schools still have the opportunity to help the child develop his potential.

Moderate undernutrition is a more common problem for the schools than is severe malnutrition. The functioning of the central nervous system is still subject to nutritional influences. Undernutrition causes lessened energy, reduced ability to concentrate, easy fatigue, and reduced ability to deal with one's environment. The adverse effects of moderate undernutrition can be reversed with continued use of nutritionally adequate diets—in cases where undernutrition is the only problem present. However, undernutrition is usually accompanied by other problems such as infection, poor sanitation, disease, and adverse environment.

## NUTRITION EDUCATION IN THE SCHOOLS

The school has an important role in promoting and maintaining the nutritional well-being of a child so he may learn and function at desirable levels. Nutritional well-being can be aided by parents and the community.

The objectives of nutrition education are to influence:

- (1) How children feel about food—their attitudes.
- (2) How children behave—their food habits.
- (3) What children know—their understanding of nutrition information.

The school program alone cannot attain these objectives. Children learn constantly; they learn from all sources to which they are exposed. The interest and cooperation of the home are valuable in developing and maintaining wholesome attitudes about food and good food habits. The school program, however, can and does influence children's attitudes about food and food habits.

The school is a source of sound nutrition information. The school lunch serves as a major tool for a comprehensive school program. Classroom activities, school health services, and communication with home and community complement the school program. Nutrition education in the schools is ideally presented as a sequential program of food information and experience from kindergarten through twelfth grade.

### Effective approaches of nutrition education

Research in nutrition education indicates that the following approaches are effective in school programs (9). In early elementary years, it is important for children to develop wholesome attitudes toward foods and to establish and/or maintain good eating habits. Children learn to identify the foods they eat. The variety of foods they can eat with enjoyment is increased. They learn to eat comfortably in a group situation. Their knowledge about food increases. They become aware of where food comes from; how we get it; how it is handled; how it is prepared.

In later elementary years, children become interested in how food affects them. They learn that food makes a difference in how they look, how they feel, and how they grow and develop. These children are curious about the how, what, and why of things, and hence are ready to study about nutrition.

In secondary school, the emphasis should be on increasing factual knowledge of nutrition because it was not a primary portion of the program in earlier years.

### School feeding program

The school lunch can contribute strongly to the entire school nutrition program in addition to offering the child a nutritionally satisfactory and esthetically pleasing meal.

The meal ideally combines foods that provide contrasts in flavor, texture, and color. It should be tastefully prepared and attractively served. A pleasant, positive manner on the part of those who serve the meal is desirable. The occasional inclusion of unfamiliar foods in the lunch will help children increase the variety of foods they enjoy.

The school feeding program can aid other segments of school nutrition education. Foods can be supplied for tasting parties and for other classroom activities. Children can be introduced to the school kitchen and learn to identify the foods they are eating. Older children can investigate the nutritional value of foods.

### **Classroom teaching**

The classroom teacher is the primary source of sound nutrition information and is responsible for implementing the sequential program of nutrition education outlined earlier.

Wholesome attitudes toward food can be developed or increased. Food experiences can be increased by eating and, if possible, preparing foods in conjunction with geography or history studies. The foods that are to be served for lunch can be discussed with younger children prior to the meal.

### **School health service**

The school health service can help by noting the nutrition problems of children. Parents need to be made aware of the situation and of how to improve their children's nutritional status. Medical attention, when necessary, needs to be recommended. The health service can also enter into education programs concerning the positive approaches to good food and health habits.

### **Parent and community involvement**

Another role of the school is to involve parents and the community in the nutrition program. This aspect of the program requires interest on the part of the school staff and coordination with community organizations which have an interest in disseminating nutrition information.

The nutrition program can be projected into the home in a number of ways. Menus of lunches can be published

in a school or local paper. Family-size recipes of foods served in the school can be made available to parents. Through the Parent Teachers Association, parents can be reached with information on nutritional and economic benefits of typical lunches. Also, parents should have an opportunity to converse with the school-lunch staff about the lunch program.

Sound and positive nutrition education programs in the schools, augmented by interest and cooperation from parents and community, will help children attain nutritional well-being and maintain it into their adult years.

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